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DEFENSE SYSTEMS MANAGEMENT COLLEGE

PROGRAM MANAGEMENT COURSE
INDIVIDUAL STUDY PROGRAM

UTILIZATION OF PERFORMANCE INCENTIVES IN PRODUCTION CONTRACTING

STUDY PROJECT REPORT
PMC 76-2

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FORT BELVOIR, VIRGINIA 22060

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DEFENSE SYSTEMS MANAGEMENT COLLEGE

STUDY TITLE:

Utilization of Performance Incentives in Production Contracting.

STUDY PROJECT GOALS:

To gain an appreciation of the usefulness and useability of performance incentives in production contracting. To investigate various forms of contractor motivation in the production phase.

STUDY REPORT ABSTRACT:

Contract types in general and contract incentives specifically are discussed in order to provide a foundation for an analysis of performance incentives in production contracting. Pure performance incentives and other contractor motivational methods are discussed, with emphasis on the product assurance parameters of production contracting (i.e., quality, reliability, and maintainability). Final emphasis is made on tailoring contract structure to the specific program requirements along with a recommendation concerning the use of quality and/or reliability motivators.

SUBJECT DESCRIPTORS:

Contracts, Incentives, Performance, Production

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UTILIZATION OF PERFORMANCE INCENTIVES IN PRODUCTION CONTRACTING

Study Project Report

Individual Study Program

Defense Systems Management College

Program Management Course

Class 76-2

by

James Robert Knepshield
GS-12 DNC

November 1976

Study Project Advisor
Dr. Joseph Hood

Executive Summary

The Department of Defense is placing increasing emphasis on obtaining defense equipment which fully meets all requirements at the lowest cost possible. The production phase of weapon system acquisition presents unique and special contractor motivational challenges. One of the prime motivational tools in use today is the contractual incentive, including cost, schedule and technical performance. It is important to tailor the incentive type to the program situation, including such considerations as program phase, risk assessment, available funds, and Government goals for the contract.

Incentives in the production phase are normally placed on cost only. Although many arguments exist for not placing an incentive on performance in any phase, let alone production, it appears that performance incentives based on quality and reliability parameters could be of significant value to the Government if properly applied. Improvements in quality and reliability and avoiding contractor quality - cost tradeoffs would be obvious benefits.

Other quality and reliability contractual motivators, including award fees and the Reliability Improvement Warranty, are discussed. The recommendation is made for consideration of some type of quality and/or reliability motivator in future production contracting as a means toward achieving weapon system performance requirements within ever tightening cost constraints.

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Section I - Introduction

In this era of technological complexity and spiraling costs, the Department of Defense (DOD) is placing increasing emphasis on weapon system life cycle costs and equipment readiness. While the total number of dollars in the Defense budget increases each year, the buying power of those dollars is decreasing. This fact, coupled with an ever increasing foreign threat to our national security, is forcing the DOD to place significant emphasis on obtaining defense equipment which fully meets all requirements at the lowest cost possible. In the process of designing, developing, and producing weapon systems, contractors must be encouraged to become more efficient.

One method of contractor "encouragement" is through the use of contractual financial incentives. The objective of any incentive contract is to motivate the contractor to earn more compensation by achieving better performance and controlling cost (8:viii)[1]. The reduction and control of cost is receiving tremendous emphasis in the DOD today. But many fear that in our haste to reduce costs, we may overlook the fact that the cost of a piece of defense equipment which does not function properly when needed is infinite. Today's weapon system must do more than simply meet a design requirement in a

[1]This notation will be used throughout the report for sources of quotations and major references. The first number is the source listed in the bibliography. The second number is the page in the reference.

controlled laboratory environment. It must be ready for use in the field and it must be ready for use when it is needed.

The trend in recent years has been toward incentive contracting in an attempt to motivate contractors to reduce costs and improve technical and schedule performance. Contractual performance incentives have been utilized with apparent success in design and development contracting. The purpose of this paper is to explore methods of similarly motivating the contractor in the production phase. Key issues to be addressed: Are performance incentives suited for production contracting? If so, how? If not, what alternatives are available to motivate the contractor toward building and providing higher quality and more reliable weapon systems?

In general, we in the DOD seem to do a fairly good job of designing and developing new weapon systems. It appears to some individuals that our track record in the successful production of these weapon systems is not as good. Exploring ways of improving this "track record" is the basis of my concern for "Utilization of Performance Incentives in Production Contracting." The next section incorporates a discussion of incentive contracting principles which will lead into the discussion of production contracting performance incentives.

Section II - Incentive Contracting

During the six year period from 1956 through 1961, the use of Cost Plus Fixed Fee (CPFF) contracts increased from 24.1% of military procurement dollars obligated in 1956 to 36.6% in 1961 (7:1). The practice of utilizing CPFF contracts to procure as a package, research, development and production of experimental models developed during this period. In addition, the CPFF contract was frequently used to procure production equipment. The use of the CPFF contract was justified on the basis that it provided the necessary flexibility needed by the Government for changing the scope and technical effort as required. But in the early 1960's, the Government began to feel that the natural force in American industry to produce better products at lower cost was being stifled by the CPFF contract method which minimizes the profit motivation factor. As a result, the DOD substantially increased its emphasis on contractual incentives as a means for promoting greater contractor efficiency. The use of contractual incentives incorporates the concept of making the contractor's profit or fee dependent on actual contract cost and, to a lesser extent, on adherence to schedule and satisfaction of contract performance goals.

Prior to discussing the motivational aspects of contract incentives, a discussion of the various contract types is in order. There are two basic types of contracts: fixed price, and cost reimbursement. In a fixed price contract, a pre-

negotiated price is established which represents full payment for the work which must (1) meet established minimum performance standards, and (2) be delivered according to a specific schedule. Full cost responsibility and therefore maximum profit incentive are achieved with a fixed price contract (i.e., the contract price is fixed regardless of the contractor's actual costs). A cost reimbursement contract provides little or no motivation to increase profit or control costs because the Government has agreed to reimburse all contractor costs. The contract fee is either fixed or variable, depending on contract type. Under a Cost Plus Fixed Fee (CPFF) arrangement, unless a change in contract requirements occurs, the fee can neither be increased nor decreased based on actual contractor performance. Other forms of cost reimbursement contracts are discussed later in this section.

But this is not to say that the fixed price contract is always the "right" contract. It is vital that both the Government and the contractor work together to tailor the contract type to the situation. Situational characteristics such as risk, phase of program, ability to define the work to be accomplished, stability of evaluation criteria, and ability to estimate costs are among the important criteria which must be evaluated in the contract type selection process.

Contract incentives are used to strike a middle ground

between the two extremes presented above by motivating the contractor to earn a larger profit through better contract performance. The specific purpose of the incentive is to motivate the contractor to a level of performance which is in the best interest of the Government. A meaningful incentive will result in the contractor initiating specific new or additional efforts that would otherwise not have been performed. The incentive must be carefully structured to properly communicate the Government's objectives to the contractor. In addition, they should motivate the contractor's management to convey the Government's objectives within the contractor's organization. Unless the workers understand the Government's objectives and are motivated to a higher level of performance (cost, schedule and/or technical performance), the incentive has failed.

The two most common types of incentive contracts are the Cost Plus Incentive Fee (CPIF) and the Fixed Price Incentive (FPI) contracts. Under a CPIF contract, the contractor is reimbursed for all costs incurred which meet the "allowable cost" test of the Armed Services Procurement Regulation (ASPR), Section XV, plus a fee which is based on an increase or decrease of the contract target fee. These fee adjustments are made in accordance with predetermined and agreed upon contract formulas. CPIF contracts can be based solely on cost or they can incorporate schedule and/or technical performance as well as cost incentives.

The CPIF contract has five basic elements: target cost, target fee, minimum fee, maximum fee, and cost share ratio. Each of these elements is negotiated prior to contract finalization. In addition, each incentive parameter in the contract has a target, a maximum and minimum limit, and an incentive formula. The CPIF contract does not have a ceiling price.

The FPI contract differs from the CPIF in that the contractor is reimbursed for allowable costs incurred up to a cost ceiling, above which all costs are deducted from his profit until the profit is exhausted. Adding profit to the cost ceiling results in the price ceiling, above which the contractor receives no further payment. There are two types of FPI contracts. Under a Fixed Price Incentive with Firm Target contract, a firm target cost, target profit, price ceiling, and sharing formula are established before the contract is signed. A Fixed Price Incentive with Successive Targets contract provides for the resetting of the target and ceiling costs at least once after the contract is signed and is used when realistic pricing data is not initially available but is expected to be available during the period of contract performance. In both types of FPI contracts, the Government and the contractor share cost savings below the cost ceiling according to a negotiated sharing formula.

An interesting comparison can be made between the CPIF and the FPI contract structures. In a CPIF arrangement, a

point is established both under and over target cost where the fee becomes fixed at the maximum or minimum levels. Contractor sharing ceases at this point, and the contract, in effect, converts to a Cost Plus Fixed Fee (CPFF) 100/0 sharing arrangement (100% Government/0% contractor). But in an FPI contract, the ceiling price establishes a Point of Total Assumption. This is the point at which the sum of cost and adjusted profit equals the ceiling price. Costs incurred above this point are borne completely by the contractor and, in effect, the contract becomes a Firm Fixed Price (FFP) with a 0/100 share formula (0% Government/100% contractor). It is thus apparent that the degree of contract cost uncertainty is a major determinant of incentive contract type. Where cost uncertainties are too great to negotiate a realistic ceiling price, the CPIF contract is desirable. On the other hand, an FPI contract can be used when neither the Government nor the contractor have the confidence to negotiate an FFP, but the uncertainty is such that the contractor is willing to take the risk at the established ceiling price.

The Cost Plus Award Fee (CPAF), while not an incentive contract per se, has some interesting motivational characteristics. It is a cost reimbursement arrangement which provides for both a base fee and an additional fee which may be awarded based on periodic Government evaluations of the contractor's performance. The award fee can be given wholly or in part and its amount is a judgemental determination made

unilaterally by the Government.

In the application of contract incentives, the ASPR makes the basic assumption that the contractor strives to maximize profit for each and every contract. There is much controversy about the validity of this assumption. A 1968 Logistics Management Institute (LMI) study concluded that contractors do not attempt to maximize profit on each and every contract. The following is an exerpt from the study:

> There is virtually unanimous agreement among managers and analysts who have studied overall contractor motivation that, in the short-run, contractor management does sacrifice short-run profit on defense business in favor of achieving:
>
> (1) company growth
> (2) increased share of the industry market
> (3) better public image
> (4) organizational prestige
> (5) carry-over benefits to commercial business (commercial spinoffs)
> (6) greater opportunity for follow-on business, or
> (7) greater shareholder expectations for future growth and profit (3:8).

There are indications that contractors are motivated basically to cover their cost line, with profit being a secondary consideration (10:0). Stated more simply, the prime consideration of many contractors is simply to stay in business.

Thus it appears that contractors do not attempt to maximize profit on each and every contract, but that they attempt to optimize among many objectives, especially those which contribute to maintaining or improving their market position and assuring their future stength. Does this

empirical evidence which seemingly discredits the ASPR profit motive assumption mean that contract incentives are without value? No, but it does provide an even stronger argument for very careful selection and application of contract incentives.

An LMI study, based on a survey of Government contracting personnel in 1965-67, summarized the purposes of, and justification for contract incentives in the four general statements which follow:

(1) Incentives motivate efficient contract management and achievement of a high performance product.
(2) Incentives enable the Government to reward contractors on the basis of demonstrated management ability and product performance.
(3) Incentives assign to the contractor a larger portion of contract risk than he would bear with a CPFF contract.
(4) Incentives provide explicit communication of the Government's contracting objectives (3:3).

One additional conclusion is made in the LMI study. Contractors will not sacrifice performance attainment for profit. Performance is of such importance to company image and future business acquisition that all performance incentives provide little, if any, additional motivation to the contractor (3:13).

One final item worthy of discussion in this general section on incentive contracting is that of trading-off the various incentivized parameters in a multi-incentive contract arrangement. While the opportunity for trade-off unquestionably exists, it appears that in most cases, even in the early phases of system design, a contractor becomes committed to a single technical approach relatively early in the life of a

program. The opportunity for the utilization of technical trade-offs diminish as a weapon system matures and moves through development and into production. Therefore, throughout most of a weapon system's acquisition cycle the contractor is restricted to relatively minor cost versus schedule trade-offs.

> After a program is organized and the management team has started to carry out the contract, it is unrealistic to expect that opportunities will exist for the exercise of trade-offs significantly affecting performance. Hence the utility of performance incentives is severely inhibited (3:16).

A general discussion of contract incentives, with some specifics on performance incentives, has been presented in this section. This background, plus some further groundwork, will allow the subject of contractor motivation in a production contract to be analyzed in the next section.

Section III - Performance Incentives in Production Contracting

The Department of Defense divides major system acquisitions into the following program phases: Conceptual, Validation, Full-Scale Engineering Development, Production, and Deployment (2:3). For the purpose of this paper, the emphasis is on the utilization of performance incentives when contracting in the production phase.

Frederick M. Scherer, in his book The Weapons Acquisition Process: Economic Incentives, discusses the production phase:

> As a weapons program progresses into its production stages, the use of fixed-price type contracts becomes increasingly acceptable to both buyer and seller. Quality-cost trade-offs become more constrained. With specifications defining in detail the product to be exchanged, the government can assume that the contractor delivers what was promised and the contractor can ensure that it will be asked to deliver no more than what was promised (17:191).

Mr. Scherer continues:

> Fixed-price incentive contracts offer a satisfactory compromise between risk aversion and other objectives for both contractors and government negotiators, and therefore they are used much more extensively than firm fixed-price contracts to cover the production of major advanced weapon systems and subsystems (17:225).

Prior to analyzing that portion of the above mentioned incentives dealing with performance, a definition of performance is in order. The term performance takes on somewhat different meanings depending within which of the above phases a program happens to be. In the conceptual phase, weapon systems designers are interested in generating, analyzing,

and trading-off various alternative approaches to meet the operational requirements of the weapon system. Concern for "performance" in this phase is almost exclusively devoted to showing on paper alternative methods for attaining specific "physical attributes" requirements (i.e., weight, speed, range). In the validation phase, one specific design is formulated. Performance in this phase continues to be primarily concerned with specific "physical attributes," although concern for system operation and support (i.e., integrated logistics support, reliability, maintainability) should be growing. Amplification on these factors occurs further in the paper. In the full-scale development phase, concern for performance normally includes finalization, verification, and validation of both the "physical attributes" and the operation and support parameters. In the production phase, emphasis should be placed on ensuring that the design characteristics (performance) inherent in the final design are not compromised in the manufacturing process.

Many procurement specialists feel that usually the only factor which can be effectively incentivized in production is cost. Incentives on items other than cost do very little to change what the contractor does in producing articles (10:0).

A summary of findings from an LMI study on performance incentives follows:

(1) The contractor considers a reputation for technical competence to be critical to the future

> business success and hence is strongly motivated for technical accomplishment. Performance attainment overbalances immediate financial gain in contractor trade-off decisions. Consequently, performance incentives are unnecessary either to assure stress on performance or to create a balanced emphasis among cost, schedule and performance.
>
> (2) Contractor trade-off decisions significantly affecting performance are made during preparation of proposals, conduct of Contract Definition and planning of the development effort. Trade-off opportunities do not exist for the contractor to be guided by performance incentives in carrying out the development (3:18).

The LMI study concluded by recommending that the use of performance incentives in development contracts be discontinued. If incentives are inappropriate in the development phase, they would be even less appropriate for the production phase.

This evidence strongly points toward not utilizing performance incentives in production contracting. Prior to entering the production phase all performance parameters that are going to be achieved have probably already been achieved. The weapon system's development is (or should be) complete, its design is validated, and its specifications are firm. The Government's major concerns are cost and ensuring that the product produced in quantity performs to the standards established and demonstrated in the earlier program phases. Mr. Scherer, in his book on incentives, devotes an entire chapter to automatic contractual incentives in production programs. His discussion throughout that chapter is devoted to cost incentives only. But he includes a very interesting discussion on cost-quality trade-offs as a way

of reducing contract costs (17:236). The Government must be wary of complacency after the production contract is issued and not allow the contractor to trade-off quality for cost incentive dollars. A performance incentive on quality might be an appropriate deterrent.

One of our military's major strategic weapons systems, in an Engineering Design Finalization/Initial Production procurement contract recently issued for guidance subsystems, is utilizing a multiple incentive contract structure. Incentives in that contract are on cost, schedule, and quality, with the quality incentive weighted roughly equal with cost and schedule combined. This is an innovative incentive structure and may very well be given increased attention in the future.

Another example of production performance incentives was found. The Naval Air Systems Command, in its recently awarded contract for the Navy Standard Airborne Computer, has incorporated an incentive on reliability and maintainability. The contract, as structured, is for Engineering Development hardware with an option for follow-on production units. The development units are being procured under a CPIF contract with an option for a quantity totaling eighty. An additional option calls for procurement of up to 180 production units under an FPI contract. The incentive on reliability and maintainability applies equally to both options. The reliability and maintainability incentive is based on the following:

A) Reliability and Maintainability program accomplishments as demonstrated in design reviews. Maximum incentive fee is 1.5%.

B) Demonstrated Mean Time Between Failures during a 250 hour All Equipment Test of the first 67 production units. Maximum incentive fee is 1.25%.

C) Achieved Maintainability during a Maintainability demonstration based on demonstrated Mean Time to Repair results. Maximum incentive fee is 0.25%.

While there is much evidence to discount the consideration of utilizing performance incentives in production contracting, it appears that quality/reliability incentives may have a place in production contracting after all. A discussion of various quality/reliability "motivators" appears in the next section.

Section IV - Product Assurance Motivators

Mr. Scherer states that performance in a weapon system is multidimensional, including quality, time of availability, and cost. He adds:

> Quality can in turn be subdivided almost indefinitely to measure a weapon system's technical performance in terms of speed, range, accuracy, destructive force, maneuverability, reaction time, and so on; together with its reliability, that is, the probability that the system will in fact sustain its technical performance potential in combat (17:3).

The term "product assurance" combines the quality assurance and reliability and maintainability characteristics into a single program discipline. Product assurance is a factor which is being given increased emphasis in today's world of DOD weapon system acqusition.

> Experience with some 500 major procurement actions in the Naval Material Command during the past two years reveals that performance has seldom been a limiting factor; indeed, performance has usually exceeded requirements. At the same time, however, reliability requirements, which in some instances were questionably low to begin with, are being missed by wide margins; yet many of these products will be in service for 10 - 20 years or more. A high-performance product has little value, even as a deterrent, if it cannot consistently deliver this performance because it is either broken down or breaks down immediately upon being pressed into service (20:15).

Reliability is an important part of system performance. Reliability deficiencies not only result in decreased performance capability, but also in increased maintenence costs, increased spare parts procurements, and expensive design

changes and component retrofits. While it appears to be unreasonable to apply an incentive during the production phase for one of the "physical attributes", it very well may be worthwhile to attempt to motivate the contractor to strive towards higher quality and greater reliability during production.

The recognition that reliability equals or exceeds performance in priority and importance is to be a key consideration in all future Navy requests for proposals, technical specifications, and contractual requirements (13:0). Clearly, in this era of spiraling costs and reduced buying power, we must all realize that highly reliable weapon systems requiring far less support are the only means of ensuring proper levels of combat readiness while holding the line on life cycle costs.

Procurements with incentives on quality and reliability were discussed earlier. The Naval Air Systems Command appears to be experimenting with another reliability incentive in one of its tactical missile production (FPI) contracts. In an upcoming contract, an incentive on reliability growth curve slope is anticipated. The contractor's demonstrated performance in the first production run will be used as a baseline (10:0).

One of the key problems one faces in the use of any contractual incentive is that the incentive structure must be firm prior to the contract performance. The contract

incentive does not allow for subjective evaluations of the contractor "after the fact." For a quantitative factor like cost, this is probably not a problem. But for qualitative factors like management performance or for a parameter like reliability (which cannot be fully evaluated until sometime after the completion of the contractor's performance period), alternatives to incentives may be desirable.

Utilization of the award fee concept for the qualitative and time-dependent factors discussed above seems to have merit. The award fee concept, as discussed earlier, allows the Program Manager to "grade" the contractor on his contractual performance. The following is from a discussion of development phase reliability emphasis:

> If competition does not exist contractors can be motivated to develop an aggressive reliability improvement program through the use of award fee-type contracts in lieu of the more traditional incentive arragements, which generally suffer from an inability to develop meaningful measurement criteria at this stage of design (19:22).

It would also seem feasible for the Program Manager to award a post contract reliability performance fee to the contractor based on the in-service use performance of the weapons system.

It is vitally important to tailor acquisition strategy to the weapon system's characteristics and requirements. Mr. Rober F. Trimble, Assistant Administrator for Contract Administration, Office of Federal Procurement Policy, makes the following conclusions in relation to weapon system

reliability problems:

> (1) Contract specifications or incentives will not improve reliability without careful planning and management conducted between the Government and the contractor.
>
> (2) Contract incentives can be counterproductive, particularly in contracts which contain detailed technical specifications and complex multiple incentives.
>
> (3) Skillful development of an acquisition strategy, involving "cradle to grave" considerations relating to both the user and the seller, offers the greatest possibility for motivating contractors to improve reliability. Incentive contracts can be productive if used properly in this process (19:21).

One of the newest system acquisition concepts being utilized in the DOD today is the Reliability Improvement Warranty (RIW). Under the RIW concept, the contractor is responsible for the repair or replacement of failed units for a prescribed period of time at his own manufacturing facility. Tailoring is very important in that the agreed-upon contractual price for the RIW activity must be carefully related to reliability performance predictions based on tests of the equipment conducted in earlier phases of the program. If the equipment fails to perform as predicted, the contractor must underwrite the added expense for repair or replacement (19:23). The apparent goal of RIW is that the contractor will be motivated to (1) design, produce, and maintain acceptable reliability, (2) ensure quality standards are maintained during production, and (3) to identify and correct design deficiencies as soon as possible because performance

which exceeds the predicted contractual levels results in added contractor profit. Off-setting these motivational advantages are the facts that RIW requires extremely careful management and can involve significant logistics problems (since equipment cannot be repaired on site, but must be returned to the contractor) (13:0). Engineering Change Proposals (ECP's) play an important role in the RIW concept.

> As the name implies, reliability improvement is the major feature of an RIW. By directly observing all field failures and being responsible for repair, the contractor can quickly identify failure patterns and institute appropriate corrective action through ECP's. The ECP's, by terms of the warranty, are introduced at no cost to the Government (4:25-4).

In addition to Government management requirements in the areas of equipment pipeline flow, configuration and change (ECP) control and warranty cost, RIW requires careful Government attention to the following decisions; length of coverage, types of exclusions, turnaround time requirement and unverified failure conditions (4:25-5). It thus appears that the RIW offers substantial potential as a reliability improvement incentive as long as it is carefully tailored to the situation and carefully managed by the Government.

The Navy's Harpoon Program recently considered another type of performance incentive for its initial production contract. The incentive fee would have been based on the percentage of missiles which successfully pass their acceptance test during the first attempt. While the concept has

some merit, it was not implemented in this case, mainly because much of the missile hardware had already been produced. Even though the Government had not yet accepted this hardware, the opportunity for the contractor to make improvement changes was minimal (18:0). And as discussed in Section II, a meaningful incentive will result in the contractor initiating specific new or additional efforts that would otherwise not have been performed. Although not appropriate in this case, the concept of performance incentives based on hardware acceptance tests could be a consideration for the future.

Various existing and candidate production phase product assurance "motivators" have been discussed in this section. In the final section the various concepts and incentive methods will be tied together in the form of conclusions and recommendations.

Section V - Conclusions and Recommendations

As a new weapon system enters the production phase, the Government program manager and contracting officer need to consider the value of performance incentives along with other forms of contractual motivators. Should the production contract contain incentives in an attempt to improve product performance? Is there a better way to motivate the contractor to produce a more reliable weapon system?

These questions are indeed controversial. Evidence has been presented which indicates that cost is the only parameter for which a production contract incentive is beneficial. But, the concern for quality and reliability in our weapon systems is growing significantly. This concern is being driven by increased costs and the use of more complex systems resulting from our nation's technological advances.

There are, of course, no concrete answers to the above questions. But I do recommend that strong consideration be given to the use of quality and reliability motivators in future production contracting. These can be in the form of specific performance incentives on quality and/or reliability, or in other forms, such as the award fee or the RIW concept. Clearly, whatever form of motivation is used, it must be carefully tailored to the program situation. Proper planning is vital. Specific responsibility for the outcome must be established. I firmly believe that only through serious

consideration of the thoughts outlined herein will we be able to successfully procure military equipment which meets both the performance requirements and the cost contraints we face today and will continue to face in the future.

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